

WHAT IS CLAIMED IS:

- 1 ~~1. A method for reducing toner in an image comprised of raster pel data,~~  
2 ~~comprising:~~  
3 ~~determining surrounding pels of subject pels;~~  
4 ~~for each subject pel, generating a sub-pulse width power to charge a sub-pel~~  
5 ~~region within the subject pel based on a pattern of the surrounding pels of the subject~~  
6 ~~pel; and~~  
7 ~~for each subject pel, generating position information indicating an alignment of~~  
8 ~~the sub-pel region in the pel, wherein the position information is used to position the~~  
9 ~~sub-pel region produced by the sub-pulse width power in the pel.~~
- 1 2. The method of claim 1, wherein toner is attracted to the charged sub-  
2 pel region.
- 1 3. The method of claim 1, wherein the position information clusters the  
2 sub-pel region of adjacent pels in order to reduce electrogrmanetic radiation.
- 1 4. The method of claim 1, further comprising:  
2 for each subject pel, determining whether the pattern of the surrounding pels  
3 indicates that the subject pel is in a black filled region, wherein the position  
4 information is used to align the sub-pel region in the subject pel in the black filled  
5 region to be adjacent to the sub-pel region in one adjacent subject pel in the black  
6 filled region.
- 1 5. The method of claim 4, wherein the alignment of the sub-pels forms a  
2 checkerboard pattern.
- 1 6. The method of claim 1, wherein the sub-pulse width power and  
2 position information is encoded in a look-up table that provides one output sub-pulse

1 ~~width power and position information for an input subject pel and surrounding pel~~  
2 ~~pattern.~~

1 7. The method of claim 4, wherein the surrounding pels include pels from  
2 the scan line including the subject pel and from scan lines adjacent to the subject pel,  
3 wherein the subject pel is in the black filled region if a plurality of the surrounding  
4 pels are all black.

1 8. The method of claim 7, wherein the subject pel is in the black filled  
2 region if the plurality of the pels that surround the subject pel that are all black form a  
3 cross shape.

1 9. The method of claim 7, wherein the surrounding pels and subject pel  
2 form a data window of pels, further comprising:  
3 encoding pel positions in the data window to include location information of  
4 the subject pel with respect to other pels if the subject pel is in one black filled region;  
5 and  
6 using the position information to align the sub-pel regions in the subject pels in  
7 the black filled region to be adjacent to the sub-pel region in one adjacent subject pel  
8 in the black filled region.

1 10. The method of claim 9, wherein the data window forms a diamond  
2 shape with the subject pel at the center of the diamond shaped window.

1 11. The method of claim 9, wherein the sub-pulse width power and  
2 position information are encoded in a look-up table that provides one output value  
3 including sub-pulse width power and position information for an input subject pel and  
4 surrounding pel pattern, and wherein the look-up table is encoded to provide the  
5 position information that is used to align sub-pel regions in pels in the black filled

1 ~~region to be adjacent to the sub-pel region in one adjacent subject pel for input data~~  
2 ~~windows that are encoded with position information.~~

1 12. The method of claim 7, wherein the surrounding pels and subject pel  
2 form a data window of pels, further comprising, for each subject pel:  
3 determining from the pels in the data window whether the subject pel is on an  
4 edge of an image of black pels; and  
5 using the data window as input to a look-up table that provides one output  
6 sub-pulse width power and position information for different input data window  
7 patterns including patterns that indicate that the subject pel is in one black filled  
8 region or on one image edge.

1 13. The method of claim 12, wherein the look-up table is encoded to align  
2 pels on the edge toward the black filled region.

1 14. The method of claim 12, wherein the look-up table is encoded to  
2 provide a sub-pulse width power level for pels on the edge that is less than the sub-  
3 pulse width power level for pels in the black filled region.

1 15. A system for reducing toner in an image comprised of raster pel data,  
2 comprising:  
3 means for determining surrounding pels of subject pels;  
4 means for generating, for each subject pel, a sub-pulse width power to charge  
5 a sub-pel region within the subject pel based on a pattern of the surrounding pels of  
6 the subject pel; and  
7 means for generating, for each subject pel, position information indicating an  
8 alignment of the sub-pel region in the pel, wherein the position information is used to  
9 position the sub-pel region produced by the sub-pulse width power in the pel.

1 16. The system of claim 15, wherein toner is attracted to the charged sub-  
2 pel region.

1 17. The system of claim 15, wherein the position information clusters the  
2 sub-pel region of adjacent pels in order to reduce electromagnetic radiation.

1 18. The system of claim 16, further comprising:  
2 means for determining, for each subject pel, whether the pattern of the  
3 surrounding pels indicates that the subject pel is in a black filled region, wherein the  
4 position information is used to align the sub-pel region in the subject pel in the black  
5 filled region to be adjacent to the sub-pel region in one adjacent subject pel in the  
6 black filled region.

1 19. The system of claim 18, wherein the alignment of the sub-pels forms a  
2 checkerboard pattern.

1 20. The system of claim 15, wherein the sub-pulse width power and  
2 position information is encoded in a look-up table that provides one output sub-pulse  
3 width power and position information for an input subject pel and surrounding pel  
4 pattern.

1 21. The system of claim 17, wherein the surrounding pels include pels  
2 from the scan line including the subject pel and from scan lines adjacent to the subject  
3 pel, wherein the subject pel is in the black filled region if a plurality of the  
4 surrounding pels are all black.

1 22. The system of claim 21, wherein the subject pel is in the black filled  
2 region if the plurality of the pels that surround the subject pel that are all black form a  
3 cross shape.

1 ~~23. The system of claim 21, wherein the surrounding pels and subject pel~~

2 form a data window of pels, further comprising:

3 means for encoding pel positions in the data window to include location  
4 information of the subject pel with respect to other pels if the subject pel is in one  
5 black filled region; and

6 means for using the position information to align the sub-pel regions in the  
7 subject pels in the black filled region to be adjacent to the sub-pel region in one  
8 adjacent subject pel in the black filled region.

1 24. The system of claim 23, wherein the data window forms a diamond  
2 shape with the subject pel at the center of the diamond shaped window.

1 25. The system of claim 23, wherein the sub-pulse width power and  
2 position information are encoded in a look-up table that provides one output value  
3 including sub-pulse width power and position information for an input subject pel and  
4 surrounding pel pattern, and wherein the look-up table is encoded to provide the  
5 position information that is used to align sub-pel regions in pels in the black filled  
6 region to be adjacent to the sub-pel region in one adjacent subject pel for input data  
7 windows that are encoded with position information.

1 26. The system of claim 21, wherein the surrounding pels and subject pel  
2 form a data window of pels, further comprising, for each subject pel:

3 means for determining from the pels in the data window whether the subject  
4 pel is on an edge of an image of black pels; and

5 means for using the data window as input to a look-up table that provides one  
6 output sub-pulse width power and position information for different input data  
7 window patterns including patterns that indicate that the subject pel is in one black  
8 filled region or on one image edge.

1     ~~27. The system of claim 26, wherein the look-up table is encoded to align~~  
2     ~~pels on the edge toward the black filled region.~~

1     28. The system of claim 26, wherein the look-up table is encoded to  
2     provide a sub-pulse width power level for pels on the edge that is less than the sub-  
3     pulse width power level for pels in the black filled region.

1     ~~29. A computer-readable transmission medium including a look-up table~~  
2     ~~data structure used for reducing toner in an image comprised of raster pel data,~~  
3     ~~comprising:~~  
4     ~~a plurality of output values, wherein one output value is provided for at least~~  
5     ~~one pattern of pels including a subject pel, wherein the output value is substituted for~~  
6     ~~the subject pel, and wherein the output value comprises a sub-pulse width power to~~  
7     ~~charge a sub-pel region within the subject pel based and position information~~  
8     ~~indicating an alignment of the sub-pel region in the pel, wherein the position~~  
9     ~~information is used to position the sub-pel region produced by the sub-pulse width~~  
10    ~~power in the pel.~~

1     30. The computer-readable transmission medium of claim 29, wherein  
2     toner is attracted to the charged sub-pel region.

1     31. The computer-readable transmission medium of claim 29, wherein the  
2     position information clusters the sub-pel region of adjacent pels in order to reduce  
3     electrostatic radiation.

1     32. The computer-readable transmission medium of claim 29, wherein the  
2     output values for subject pels in a black filled region include position information that  
3     aligns the sub-pel region in the subject pels in the black filled region to be adjacent to  
4     the sub-pel region in one adjacent subject pel in the black filled region.

1 ~~33. The computer-readable transmission medium of claim 32, wherein the~~  
2 position information for the output values of subject pels in the black filled region  
3 aligns the sub-pel regions to form a checkerboard pattern.

1 34. The computer-readable transmission medium of claim 33, wherein the  
2 subject pels are in the black filled region if a plurality of the surrounding pels are all  
3 black.

1 35. The computer-readable transmission medium of claim 34, wherein the  
2 subject pel is in the black filled region if the plurality of the pels that surround the  
3 subject pel that are all black form a cross shape.

1 36. The computer-readable transmission medium of claim 29, wherein the  
2 surrounding pels for which an output value is provided in the look-up table data  
3 structure form a diamond shape with the subject pel at the center of the diamond  
4 shaped window.

1 37. The computer-readable transmission medium of claim 29, wherein the  
2 output values for subject pels on an image edge are encoded with position information  
3 to align the subject pels on the image edge toward a black filled region.

1 38. The computer-readable transmission medium of claim 29, wherein the  
2 output values for subject pels on the image edge are encoded with a sub-pulse width  
3 power level that is less than the sub-pulse width power level for pels in the black filled  
4 region.